PHYSICOCHEMICAL TREATMENT OF WASTE WATER

Mrs. Najeera P C

Assistant Professor (Ad hoc), PG Department of Chemistry, KAHM Unity Women's College, Manjeri, Kerala-676122, India
E-mail: najeerapc@gmail.com

Environment is the surroundings in which we live. But the contamination of our environment by pollutants is environmental pollution. The current stage of the earth that we are seeing is the cause of centuries of exploitation of earth and its resources. The environmental pollution, directly and indirectly, affects the lives of humans and other species. These living beings co-existed on the earth with human from centuries. Carbon and dust particles string up with the air in the form of smog, damaging respiratory system, haze, and these factors affect the immune system smoke. These are caused by the emission of industrial and manufacturing units by burning of fossil fuels, vehicle combustion of carbon fumes. Moreover, of birds which become a carrier of viruses and infections. Besides, it also affects the body system and body organs. Water gets contaminated easily with any pollutant whether it is human waste or chemical discharge from factories. Also, we use this water for irrigation of crops and drinking. But, because of infection they become contaminated too. Besides, an animal dies because they drink this same contaminated water. Moreover, around 80% of pollutants of land such as chemical, industrial and agricultural waste end up in the water bodies. Besides, these water bodies ultimately connect to the sea which means it indirectly pollutes the biodiversity of the sea. Because of contaminated soil and water, the crop or agricultural produce also get toxic. Furthermore, this contaminated food effect our health and organs. From the beginning of their life, these crops are laced with chemical components that reach a mass level until the time of harvest. Climate change is also a cause of environmental pollution. Also, it affects the physical and biological components of the ecosystem.

Moreover, ozone depletion, greenhouse gases, global warming all these climate changes are a cause of environmental pollution. Besides, their effect can be fatal for our upcoming generations. The irregular extreme cold and hot climate affect the ecological system of the earth. In conclusion, man has exploited the wealth of nature at the cost of his and environments health. Also, the effect that is now emerging rapidly is all because of the activities of humans for hundreds or thousands of years. Above all, if we wish to survive and continue our life on earth then we have to take measures. These measures will help is securing our as well as our next generation future .Numerous process exist for the treatment of gaseous ,liquid and solid pollutants.

In this chapter I give an overview of several key principles for treatment of waste water. The ultimate goal of waste-water management is the protection of the environment in a mannercommensurate with public health and socio-economic concerns.

PHYSICAL TREATMENT OF WATER POLLUTANTS

Water pollution is a serious problem in India as almost 70 per cent of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants.

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The most commonly used physical treatment of waste water are:

(a) Screening: The screening of waste-water, one of the oldest treatment methods, removes gross pollutants from the Waste stream to protect downstream equipment from damage, avoid interference with plant operations and prevent objectionable floating material from entering the primary settling tanks. Screening devices may consist of parallel bars, rods or wires, grating, wire mesh, or perforated plates, to intercept large floating or Suspended material. The openings may be of any shape, but are generally circular or rectangular. The material retained from the manual or mechanical cleaning of bar racks and screens is referred to as Screenings, and is either disposed of b incineration, or returned into the waste flow after grinding.

(b) Flow equalization: It is the process of controlling hydraulic velocity, or flow rate, through a wastewater treatment system. The equalization of flow prevents short term, high volumes of incoming flow, called surges, from forcing solids and organic material out of the treatment process. Flow equalization also controls the flow through each stage of the treatment system, allowing adequate time for the physical, biological and chemical processes to take place. This technology has only recently begun to be used in residential treatment systems. The flow patterns of residential treatment systems are intermittent and variable in nature, generating frequent hydraulic and organic surges. These surges can result in large quantities of solids being washed out of the system.

(c) Sedimentation: Sedimentation, a fundamental and widely used unit operation in waste-water treatment, involves the gravitational settling of heavy particles suspended in a mixture. This process is used for the removal of grit, particulate matter in the primary settling basin, biological floc in the activated sludge settling basin, and chemical flow when the chemical coagulation process is used. Sedimentation takes place in a settling tank, also referred to as a clarifier. There are three main designs, namely, horizontal flow, solids contact and inclined surface. In designing a sedimentation basin, it is important to bear in mind that the system must produce both a clarified effluent and a concentrated sludge. Four types of settling occur, depending on particle concentration, namely, discrete, flocculent, hindered and compression. It is common for more than one type of settling to occur during a sedimentation operation

(d) Flotation: Flotation is a unit operation used to remove solid or liquid particles from a liquid phase by introducing a fine gas, usually air bubbles. The gas bubbles either adhere to the liquid or are trapped in the particle structure of the suspended solids, raising the buoyant force of the combined particle and gas bubbles. Particles that have a higher density than the liquid can thus be made to rise. In waste-water treatment, flotation is used mainly to remove suspended matter and to concentrate biological sludge. The chief advantage of flotation over sedimentation is that very small or light particles can be removed more completely and in a shorter time. Once the particles have been floated to the surface, they can be skimmed out. Flotation, as currently practiced in municipal waste-water treatment, uses air exclusively as the floating agent. Furthermore, various chemical additives can be introduced to enhance the removal process.

(e) Granular medium filtration: The filtration of effluents from waste-water treatment processes involves removal of suspended solids from waste-water effluents of biological and chemical treatment processes, in addition to the removal of chemically precipitated phosphorus. The complete filtration operation comprises two phases: filtration and cleaning or backwashing. The waste-water to be filtered is passed through a filter bed consisting of granular material (sand, anthracite and/or garnet), with or without added chemicals. Within the filter bed suspended solids contained in the waste-water are removed by means of a

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complex process involving one or more removal mechanisms such as straining, interception, impaction, sedimentation, flocculation and adsorption. The Cleaning/backwashing phase differs, depending on whether the filter operation is continuous or semicontinuous. In semi-continuous filtration, the filtering and cleaning operations occur sequentially, whereas in continuous filtration the filtering and cleaning operations occur simultaneously.

CHEMICAL TREATMENT OF WASTE WATER

Chemical processes used in waste-water treatment are designed to bring about some form of change by means of chemical reactions. They are always used in conjunction with physical unit operations and biological processes. In general, chemical unit processes have an inherent disadvantage compared to physical operations in that they are additive processes. That is to say, there is usually a net increase in the dissolved constituents of the waste-water. This can be a significant factor if the waste-water is to be reused. These are the main chemical unit processes, such as chemical precipitation, adsorption, disinfection, chlorination and other applications.

(a) Adsorption with activated carbon: Adsorption is the process of collecting soluble substances within a solution on a suitable interface. In Wastewater treatment, adsorption with activated carbon is aimed at removing a portion of the remaining dissolved organic matter. Particulate matter present in the water may also be removed. Activated carbon is produced by heating char to a high temperature and then activating it by exposure to an oxidizing gas at high temperature. The gas develops a porous structure in the char and thus creates a large internal surface area. The activated char can then be separated into various sizes with different adsorption capacities. The two most common types of activated carbon are granular activated carbon (GAC), which has a diameter greater than 0.1 mm, and powdered activated carbon (PAC), which has a diameter of less than 200 mesh. A fixed-bed column is often used to bring the waste-water into contact with GAC. The water is applied to the top of the column and withdrawn from the bottom, while the carbon is held in place. Backwashing and surface washing are applied to limit head loss build-up. Expanded-bed and moving-bed carbon contactors have been developed to overcome the problem of head loss build-up. In the expanded-bed system, the influent is introduced at the bottom of the column and is allowed to expand. In the moving-bed system, spent carbon is continuously replaced with fresh carbon. Spent granular carbon can be regenerated by removal of the adsorbed organic matter from its surface through oxidation in a furnace. The capacity of the regenerated carbon is slightly less than that of the virgin carbon.

(b) Disinfection: Disinfection refers to the selective destruction of disease-causing micro-organisms. This process is of importance in waste-water treatment owing to the nature of waste-water, which harbours a number of human enteric organisms that are associated with various waterborne diseases. Commonly used disinfection methods are the following:

(i) Physical agents such as heat and light;

(ii) Mechanical means such as screening, sedimentation, filtration, and so on;

(iii) Radiation, mainly gamma rays;

(iv) Chemical agents including chlorine and its compounds, bromine, iodine, ozone, phenol and phenolic compounds, alcohols, heavy metals, dyes, soaps and synthetic detergents, quaternary ammonium compounds, hydrogen peroxide, and various alkalis and acids. The most common chemical disinfectants are the oxidizing chemicals, and of these, chlorine is the most widely used.

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(c) Dechlorination: Dechlorination is the removal of free and total combined chlorine residue from chlorinated wastewater effluent before its reuse or discharge to receiving waters. Chlorine compounds react with many organic compounds in the effluent to produce undesired toxic compounds that cause long-term adverse impacts onthe water environment and potentially toxic effects on aquatic micro-organisms. Dechlorination may be brought about by the use of activated carbon, or by the addition of a reducing agent such as sulfur dioxide (SO_2), sodium sulphite (Na_2SO_3) or sodium metabisulfite. It is important to note that dechlorination will not remove toxic by-products that have already been produced.

CONCLUSIONS

Physical and chemical treatments are very important with in the waste water treatment systems and prior to any biological and advanced treatment technologies. Its understanding and conceptual knowledge is essential for any waste water treatment systems.

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